ACENet

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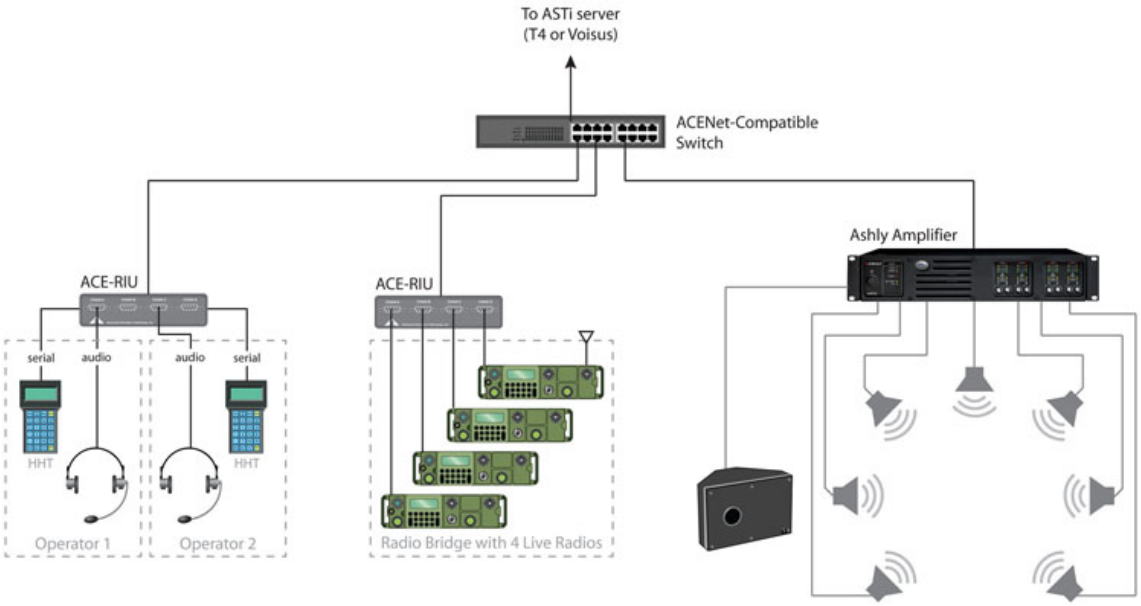
1 Introduction

The Audio Communications Environment Network (ACENet) is a low-latency network for remote audio and I/O distribution. ASTis ACE-RIU[1], ACU2[2], Ashly Amplifier, and Crown Amplifier (known as ACENet devices) distribute audio to a variety of user interfaces, including military headsets, PTT devices, HHT (Hand-Held Terminal)[3], speakers, and live radios.



This guide will provide an overview of ACENet architecture. For information about specific ACENet devices, view their individual manuals.

2 ACENet Features

- **Remote Distribution:** ACENets network-based, hub and spoke architecture provides digital audio and I/O distribution across a wide area, hundreds of feet from ASTi systems.
- **Ethernet-Based Architecture:** ACENet uses COTS network cabling and network switches (ASTi-qualified) for easy connectivity and wide, extensible distribution.
- **Scalable Architecture:** ACENet supports applications ranging from a single operator to large, multi-operator installations. ACENet-compatible switches may be used to extend the distance from the ASTi system to ACENet devices and increase the number of operators.

[1] ace_riu.html
[2] acu2.html
[3] vs_hht.html

- **Flexible Audio and I/O:** ACU2s and ACE-RIUs provide configurable audio, serial, analog and discrete I/O interfaces to accommodate a wide range of peripherals such as military and commercial headsets, audio amps, speakers, microphones, recording equipment, press-to-talk (PTT) units, simulated communications panels, Hand-Held Terminals, and other peripheral devices.
- **High Fidelity Audio:** ACENet supports synchronized, 48kHz digital audio distribution for high fidelity, realistic sound and communications simulation.
- **Low Latency:** ACENets closed network architecture and customized real-time distribution software means extremely low transport latency, which is essential for realistic simulation and elimination of delay-related audio issues.

3 ACENet Reqirements

The following are required for optimal ACENet performance:

- **Closed Network:** ACENet requires a closed network consisting of only ASTi systems, ACENet devices, and ACENet-compatible Ethernet switches.
- **Gigabit Ethernet Switch:** Up to 5 Gigabit Ethernet Switches can be added to extend the distance from the ASTi system to ACENet audio devices.
- **Category 5e Cable:** All cabling connections on the ACENet network must be Category 5e grade or higher.

3.1 Network Requirements

To preserve low latency, ACENet requires a closed network consisting of:

- ASTi servers (see the FAQs for restrictions on multiple servers in ACENet)
- ACE-RIUs, ACU2s, Ashly amplifiers or Crown amplifiers with their associated peripherals
- (Optional) ACENet-compatible Ethernet switches

ACENet connects to the ASTi server via the Eth1 interface. No other traffic should be present on ACENet.

3.2 ACENet Switch Requirements

A list of recommended switches is provided in Appendix A (chapter 5). All ACENet-compatible switches must adhere to the following core requirements:

Specifications:

- Gigabit-capable (1000 Mbps)
- OSI Layer 2 switching device

- LAN switch, (not a router or hub)

Settings:

- Auto-negotiate speed and duplex type
- Disable all advanced Layer 2 protocols. These include, but are not limited to, 802.1p/q, spanning tree and QoS.

3.3 ACENet Cabling Requirements

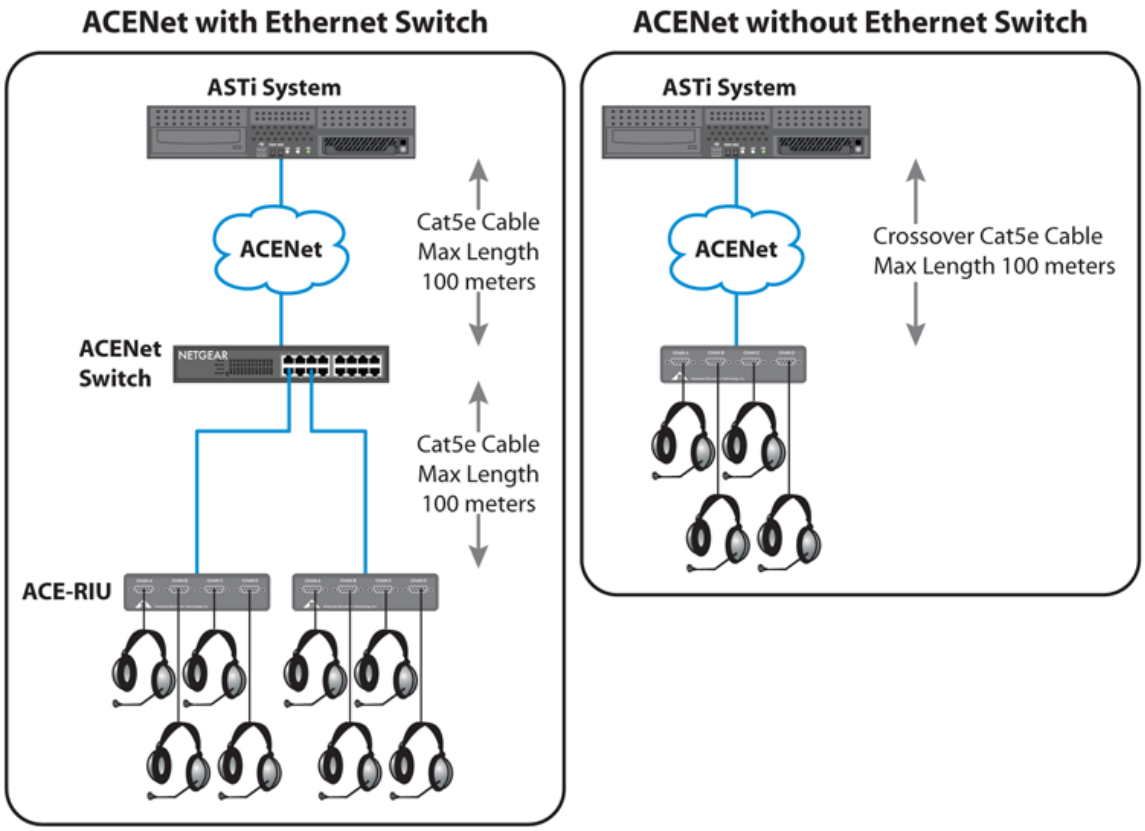
Homemade cables are the primary reason for product performance issues. ASTi highly recommends using only commercially manufactured, premium-grade cable.

- Category 5e cable or better
- 100 meters (328 feet) maximum length per cable
- Wire according to 1000BASE-T specifications

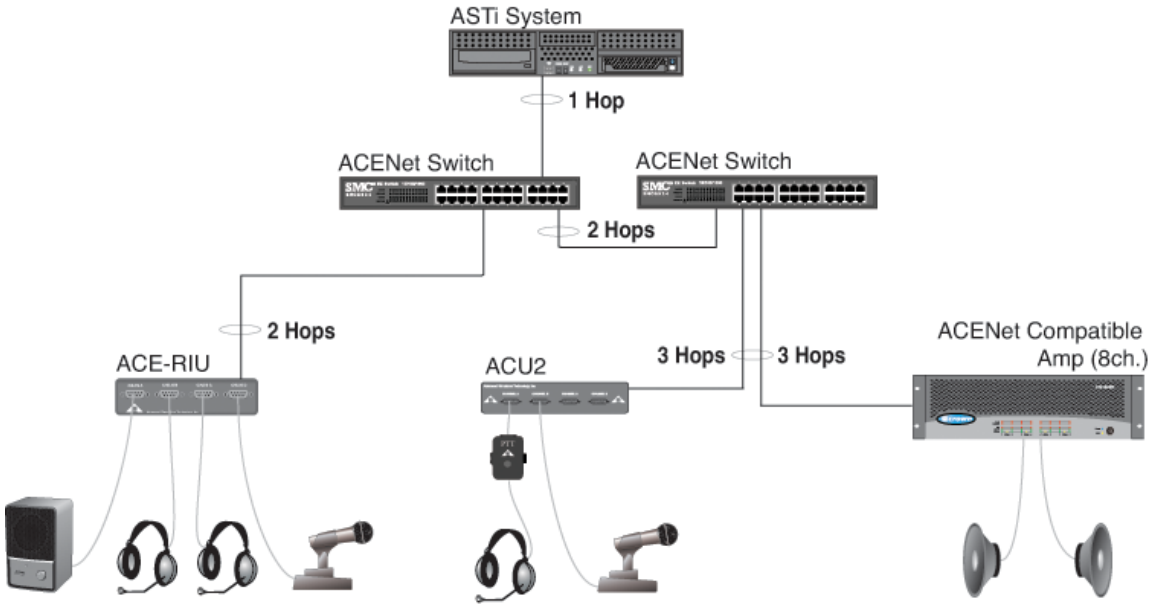
4 Frequently Asked Questions (FAQs)

4.1 Networking

- **Q:** Can I connect my ASTi system directly to the ACU2 and ACE-RIU?
  - **A:** Yes. The ASTi system can directly connect to the ACU2 and ACE-RIU with a crossover Category 5e cable between the device and ASTi system.
    Alternatively, ACENet-compatible switches may be added to extend the distance from the ASTi system to ACENet audio devices and increase the number of operators.
    Both configurations are illustrated in the figure below.



- **Q:** Can I use a hub instead of an Ethernet switch?
  - **A:** No. Hubs are not supported.
- **Q:** Can I connect a router between my ASTi system and the ACENet audio device and route ACENet packets over a WAN?
  - **A:** No. Routers are not supported.
- **Q:** Can I daisy chain switches together to extend the distance from the ASTi system to ACENet audio devices (ACE-RIUs and ACU2s)?
  - **A:** Yes. Multiple hops (links between 2 nodes) are supported. ASTi has tested ACENet with up to 6 hops (5 switches) between an ACENet audio device and ASTi system.



- **Q:** Does ACENet support multiple ASTi systems?
  - **Voisus:** No. Each Voisus system must have its own ACENet.
  - **T4:** In most cases, yes. ACENet on a T4 system can accommodate multiple Telestras, except when a Crown or Ashly amplifier is present on the network. Then it will only support one Telestra.
- **Q:** If a Crown amplifier is present on ACENet, will it support more than one Telestra system?
  - **A:** No. If a Crown amplifier is present on ACENet, it will only support one Telestra. Any other configuration is unreliable and is not supported.

4.2 Ethernet Switches

- **Q:** Do you have a list of approved switches that have been tested by ASTi?
  - **A:** Yes. Refer to Appendix A (chapter 5) in this document.
- **Q:** Can I connect my ACU2 and ACE-RIU to the same ACENet switch?
  - **A:** Yes. The ACENet network supports mixing ACU2s and ACE-RIUs on the same switch. All ASTi ACENet devices can interact on the same ACENet network. Each device must have a unique device name and device number.
- **Q:** Can my Ethernet switch run at 10 or 100Mbps?

  - **A:** No, it must run at 1000 Mbps. Attaching 10 Mbps devices to the ACENet network may disable the network.

- **Q:** I have a large switch (48 ports, for example) and would like to use part of that switch for ACENet. Is that feasible?

  - **A:** Yes. This configuration is acceptable as long as you are able to logically dedicate N ports for ACENet and these ports DO NOT see traffic from the other ports. This is sometimes referred to as a port-based VLAN.

- **Q:** Can I use VLAN tagging within ACENet?

  - **A:** Can I use VLAN tagging within ACENet?

- **Q:** My switch can be configured to run various advanced protocols such as: 802.1p, 802.1q, port priority, spanning tree, etc. Can I use these protocols? Are they required?

  - **A:** No. Advanced Layer 2 protocols are not supported. In almost all cases, the switch should run with its default settings. Possible exceptions exist if the above or similar were to be configured by default.

4.3 Additional FAQs for T4 ACE Software versions 4.17 and later

The following FAQs apply to T4 ACE software versions 4.17 and later. T4 ACE software versions 4.17 and later work exclusively with ACENet devices that have firmware version 2.x. T4 ACE software versions 4.16 and prior require firmware version 1.x. All devices sharing a local ACENet must have the same firmware version. *This section does not apply to Voisus system software.*

- **Q:** Can multiple Targets co-exist on an ACENet network?

  - **A:** Yes, as long as they communicate with different sets of ACENet devices.

- **Q:** Can multiple Targets share channels on an ACENet device?

  - **A:** No. Each ACENet device (ACE-RIU, ACU2, Crown Amplifier) can only communicate with one Target at time. A secondary Target trying to access the channels on that device will report a "Channel Reservation Error" in RMS.

- **Q:** Why does my ACENet device have a "Channel reservation error"?

  - **A:** A channel reservation error occurs when two separate Targets are trying to reserve, or use, the same channel on the ACENet device. As a rule, the first Target to install a project that contains that ACENet channel component will exclusively reserve the channel and block all other Targets from using it. So, you would need to uninstall or stop the project on the first Target to allow another Target to gain access to that ACENet channel.

- **Q:** Is there a limit to the number of ACENet devices that can exist on the ACENet network?

  - **A:** No. There is no limit unless Crown amplifiers are present. Up to four Crown Amplifiers can be placed on an ACENet network with one Target.

- **Q:** What effect does the number of ACENet devices have on the Target's real-time CPU loading?

  - **A:** The number of ACENet devices a Target can see over the network will affect the overall loading of the Targets RT CPU.This is true whether or not the ACENet device is included in the project that is running on the Target.In other words, the number of ACENet devices should be taken into account for a multi-Target ACENet.Contact ASTi for project-specific requirements.

- **Q:** My ACENet device channels have valid digital/analog I/O, but there is no audio I/O. What is wrong?

  - **A:** This symptom is seen when a Target using a software version prior to 4.17 is trying to use ACENet devices with firmware version 2.x. There are two solutions: either upgrade to ACE software version to 4.17 or greater, or downgrade the ACENet firmware to 1.x. ASTi strongly recommends upgrading to ACE software version 4.17 or greater.

- **Q:** I received an error while upgrading my ACENet firmware. What does this mean?

  - **A:** Occasionally, errors occur when upgrading several ACENet devices at one time. Try upgrading the devices a second time. If the device is still in boot mode you do not need to power cycle it before repeating the upgrade attempt.

- **Q:** What is a Device Number?

  - **A:** The Device Number is a configurable parameter that determines the address space used by the device for ACENet network communications. By default, each device is assigned a value between 1 and 4096 and every device on a given ACENet network segment must have a unique Device Number.

- **Q:** Why does my ACENet device have a "Duplicate Device Number" error?

  - **A:** A duplicate device number error occurs in the rare case when two or more ACENet devices on the network have the same device number. This condition will hamper audio communications between the Target and the ACENet devices that exhibit the error. To fix this condition, use RMS to assign a new, unique number between 1 and 4096 to the device(s) in question.

5 Appendix A: ACENet-Compatible Switches

Table 1: ACENet-Compatible Switches

Switch	Part Number
SMC*	SMCGS24
SMC*	SMC 8508T
SMC*	SMCGS16
SMC*	SMCGS8
Netgear	GS105
Netgear	GS108
Netgear	GS605
Netgear	JGS516
Netgear	JGS524
Hawking	HGS5T
Linksys	EG005W
Cisco Catalyst	6500 series
Cisco Catalyst	4900 series
Cisco Catalyst	4500 series
Cisco Catalyst	3500 series
Cisco Catalyst	2960 series
HP ProCurve	2800 series

*SMC switches are not supported if manufactured in 2012 or later due to functionality changes.

6 Appendix B: Incompatible Switches

The following switches are incompatible with the ACENet architecture.

Table 2: Incompatible Switches

Switch	Part Number
3COM	3C16478*

*Packet dropouts, possibly due to 802.1 prioritization.

7 Appendix C: ACENet Fiber Option

ACENet natively runs over an Ethernet-based (1000BASE-T) connection that is provided by the ASTi system interface (1000BASE-T), ACE-RIU/ACU2 interface (100BASE-T) and an ACENet-compatible switch (1000BASE-T). However, ACENet-compatible switches with fiber connections may successfully extend the reach of ACENet.

Important: ACENet fiber network connections are not sold as a product and have not been fully tested by ASTi. Each ACENet configuration will form a set of complex variables, which must be tested together in their functional environment under operational conditions. From experience,

each program has a unique set of issues dependent on the equipment, software and simulation deployed. Therefore, ASTi cannot guarantee success when using fiber within ACENet.

7.1 ACENet Fiber Example

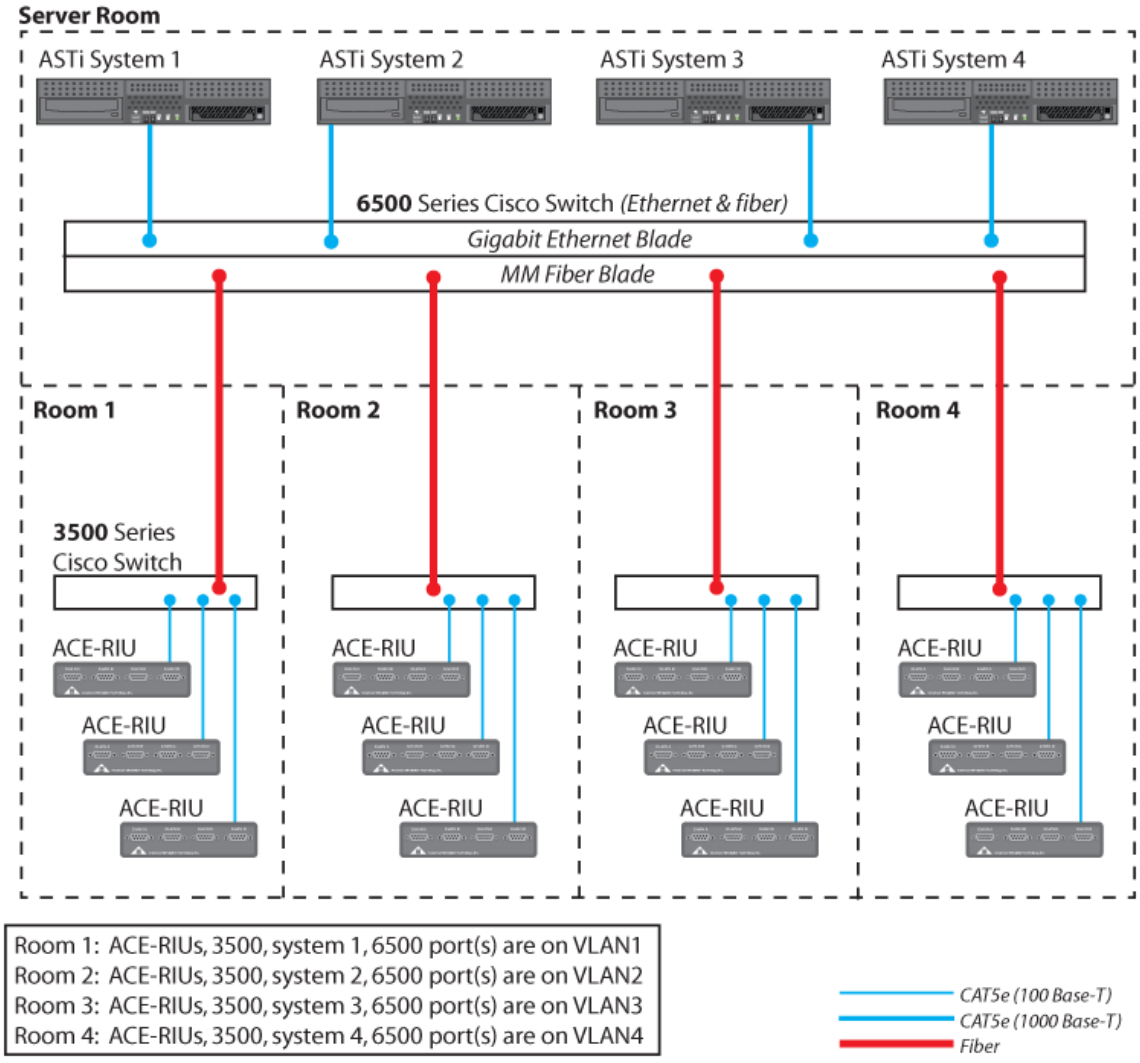
The following scenario is an example of how fiber networking may be used in an ACENet configuration.

- Server Room

  The Server Room has four ASTi systems. There is one Cisco 6500-series switch that has various blades for different ports and connections (including Gigabit Ethernet 48 port blades, MM fiber blades, and a 100M Ethernet Blade). The Cisco 6500-series switch connects via MM fiber (gigabit link) to a Cisco 3500-series switch in an OPs room. The Cisco 3500-series switches support the OPs rooms in this building or other buildings nearby.

- OPs Rooms

  Each OPs room has a single Cisco 3500-series switch. There is a fiber connection that connects the switch back to the main Cisco 6500-series switch and ultimately to the ASTi system. The Cisco 3500 switch also has 100M Ethernet ports for the ACE-RIUs within that room. In terms of data flow, it creates a port-based VLAN (this must be transparent to the system and ACE-RIUs) that consists of the systems Ethernet port, Cisco 6500 1000M Ethernet port, Cisco 6500 Fiber port, Cisco 3500 Fiber port and 1 Cisco 3500 100M Ethernet port for each ACE-RIU that the system controls.



Room 1: ACE-RIUs, 3500, system 1, 6500 port(s) are on VLAN1
Room 2: ACE-RIUs, 3500, system 2, 6500 port(s) are on VLAN2
Room 3: ACE-RIUs, 3500, system 3, 6500 port(s) are on VLAN3
Room 4: ACE-RIUs, 3500, system 4, 6500 port(s) are on VLAN4

CAT5e (100 Base-T)
CAT5e (1000 Base-T)
Fiber